In our unit, avulsion of the cord more often than not is followed by manual removal of the placenta. This radical approach undoubtedly explains our high incidence of manual removal of the placenta. Provided that there is no active bleeding, our approach should probably be more conservative. Stearn, analysing 58 cases of cord avulsion, found that manual removal was only required in 4 (6-9%).

It has been believed that a further disadvantage of the Brandt-Andrews manoeuvre is a high incidence of retained cotyledons. As the incidence of retained products requiring subsequent exploration is virtually identical in both series (0.6% in 1959 and 0.5% in 1969), it seems likely that this presumption is incorrect.

PREMATURE RUPTURE OF THE MEMBRANES*

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SUMMARY

A total of 554 cases in which membrane rupture occurred prematurely at Queen Victoria Maternity Hospital, Johannesburg during a 3½-year period is analysed in 4 groups according to birthweight, to elucidate which factor—prematurity or intra-uterine infection—carries the greater risk to the foetus. The conclusion is that pregnancy should be terminated if intra-uterine infection occurs if the foetus is judged to be over 34 weeks' gestation and that conservative treatment without antibiotics be employed when the rupture occurs between 28 and 34 weeks.

In patients presenting with premature rupture of the membranes there are two factors which influence the foetal morbidity and mortality. These factors are prematurity and intra-uterine infection. The purpose of this analysis was to elucidate which factor carried the greater risk to the foetus. Recently there has been a spate of articles which recommend immediate termination of pregnancy, irrespective of the period of gestation, as soon as the first drop of liquor appears in the vagina. Another series of articles advocates trying to prolong the pregnancy until the foetus has reached 34-36 weeks' gestation in the belief that the risk of prematurity is greater than that of infection. Most authors however agree that all pregnancies should be terminated if the membranes rupture after 36 weeks' gestation.

During a 3½-year period (1 January 1966 - 30 June 1969) there were 14 671 deliveries at Queen Victoria Maternity Hospital, Johannesburg. The membranes ruptured prematurely in 554 cases, an incidence of 3.8%. The incidence in the literature varies from 4.0% to 15.8%. In premature deliveries alone early membrane rupture occurs in 23.0%-34.0% of cases, a 3-4-fold increase as compared with mature deliveries.

METHOD OF ANALYSIS

The cases of premature membrane rupture were analysed in 4 groups according to the birthweight. The gestation period of the infants was calculated according to the intra-uterine growth chart published by Lubchenko et al. in 1963. The various birthweights were compared with one another to assess the incidence of complications in each group.

TABLE I. RELATIONSHIP BETWEEN BIRTHWEIGHT AND GESTATIONAL AGE

<table>
<thead>
<tr>
<th>Birthweight</th>
<th>Gestational age</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of cases</td>
<td>Pounds</td>
</tr>
<tr>
<td>16</td>
<td>2-9</td>
</tr>
<tr>
<td>18</td>
<td>3-5</td>
</tr>
<tr>
<td>107</td>
<td>4-7</td>
</tr>
<tr>
<td>413</td>
<td>5-8</td>
</tr>
</tbody>
</table>

Only patients in whom liquor was observed to be draining from the cervix or the vagina for more than 1 hour before the onset of labour were included in this study.

The age and parity of the patients conformed with the normal obstetric population at our hospital. We did not find an increased incidence or prematurity in patients under 20 or over 35 years of age as reported by Abramowitz and Kass in 1966. High parity did not predispose women to early membrane rupture.

Prematurity

In our series of 554 cases, the incidence of prematurity was 25.5%. In those pregnancies productive of a premature infant (141 cases), 32.6% had a previous history of premature delivery. When the infant was mature (413 cases) only 9.7% had a previous history of a premature delivery.

Presentation

The incidence of malpresentations and multiple pregnancy was not increased in the membrane rupture group as compared with the general obstetric population at the same period of gestation. The over-all incidence of twin pregnancy was 1.3%. However, when the birthweight was under 4-6 lb (2 000 g) the incidence was 60%.

Breech delivery accounted for 4.8% of the total series. The incidence in the premature group, however, was 14.0%. Transverse lie complicated 1.6% of the pregnancies. There was no difference between the mature and premature groups.

REFERENCES


*Date received: 8 April 1970.
Cord presentation was diagnosed in 0·5% of the series and was most common in babies that weighed under 3·4 lb (1,500 g). This association paralleled the high incidence of breech presentation in this group.

Labour (Fig. 1)

Labour was induced by using intravenous oxytocins. The incidence of induced labour increased with increasing foetal maturity, the overall incidence being 54·0% of the total series. The graph indicates the policy at our hospital of trying to attain a mature infant in utero before induction of labour, but if there is evidence of intra-uterine infection the pregnancy is terminated forthwith.

Maternal infection alone occurred in 28 cases, 67·9% of whom were draining liquor for less than 24 hours. Foetal infection occurred in 34 cases, 55·9% of whom were draining liquor for less than 24 hours. In 61·3% of all cases of infection, the membranes had been ruptured for less than 24 hours.

Prophylactic antibiotics (penicillin or ampicillin) were administered to half of the patients in whom the membranes had been ruptured for over 24 hours. There was no difference in the rate of infection in those patients who were managed in this way.

Infection

Maternal infection. The over-all incidence of maternal infection was 5·1% (28 cases). The majority consisted of endometritis. There were two cases of generalized peritonitis following the 41 caesarean sections. All infections were easily controlled on antibiotic therapy, except the two patients with peritonitis where prolonged intravenous therapy, nasogastric suction and intravenous antibiotics were administered.

Foetal infection. The over-all incidence of foetal infection was 6·1% (34 cases), but one-half consisted of a positive umbilical cord histology or conjunctivitis only. The other half comprised serious infection in the form of pneumonitis or septicemia. The above incidence of 6·1% is probably falsely low because in the 2·4-3·4-lb group the high perinatal mortality probably masked overt clinical foetal infection. Routine blood cultures and umbilical cord histology have been introduced only recently and 94 infants were examined in this way. These parameters will increase the number of subclinical foetal infections that are diagnosed. The perinatal loss in the 34 cases of proved foetal infection was 5·9%—all deaths occurring in the premature group.

Infection and duration of membrane rupture (Fig. 3).

Maternal infection alone occurred in 28 cases, 67·9% of whom were draining liquor for less than 24 hours. Foetal infection occurred in 34 cases, 55·9% of whom were draining liquor for less than 24 hours. In 61·3% of all cases of infection, the membranes had been ruptured for less than 24 hours.

Prophylactic antibiotics (penicillin or ampicillin) were administered to half of the patients in whom the membranes had been ruptured for over 24 hours. There was no difference in the rate of infection in those patients who...
received antibiotics as compared with those that did not receive antibiotics. In our series 75·0% of the organisms cultured were Gram-negative bacilli or anaerobic streptococci, and only 25·0% were staphylococci or other Gram-positive organisms.

![Graph](image)

Fig. 3. Duration of membrane rupture (based on 554 cases).

**DISCUSSION**

We agree with Greenhill° that the clinical assessment of premature membrane rupture is the most accurate diagnostic index.

Papanicolaou smears taken from the posterior vaginal fornix are a valuable diagnostic aid. Many authors° accept that the incidence of false negative reports is high, but if foetal squames are observed, then the obstetrician is certain that the membranes have indeed been breached. Prematurity tends to recur in subsequent pregnancies, according to Abramowitz and Kass,° and our findings are in agreement with this statement. Malpresentations, according to Gillibrand,° occur with the same frequency after the membranes have ruptured.

The perinatal mortality is influenced by the birthweight. Our own series confirms that the perinatal loss drops from 44·0% in the group below 4·6 lb, to 20·0% in the group above 4·6 lb. A birthweight of 4·6 lb corresponds, according to Lubchenko et al.,° to a gestational age of 34 weeks.

When foetal infection complicated membrane rupture the perinatal loss was 5·9%, which represented a smaller risk to the foetus than did gross prematurity. Townsend et al.,° found no reliable method of diagnosing the 'foetus at risk' in utero. Vaginal cultures, serial maternal white blood cell counts, maternal pyrexia and uterine tenderness were all inadequate parameters of infection. All pregnancies complicated by premature rupture of the membranes should be induced after 34 weeks' gestation as the risks of intra-uterine infection outweigh the risks of prematurity at this time.

Leucocytic infiltration of the umbilical cord was frequently observed in the absence of neonatal infection.° It is well known that the longer the delay before delivery, the greater the incidence of intra-uterine infection.° However, our series shows that significant infection can occur where the membranes have been ruptured for less than 24 hours. If the obstetrician decides to terminate the pregnancy by medical induction of labour, then the induction should be performed as soon as the diagnosis is established.

The maternal mortality in our series was nil. In an excellent review of 54 maternal deaths, by Webb,° the dangers of prolonged drainage of liquor were analysed. In his series, maternal death occurred in one of every 5·400 cases of premature rupture of the membranes. He stressed the importance of maternal infection which complicated 46 of the 54 deaths, and of amniotic fluid embolism in 7 of the 54 cases. The conclusion reached was that there is any evidence of intra-uterine infection the pregnancy must be terminated immediately, by caesarean hysterecomy if necessary, and prompt massive parenteral antibiotic and resuscitative therapy must be instituted. We agree with Townsend et al.° that the organisms isolated from vaginal cultures are not necessarily the organisms which infect the foetus. In our series 75·0% of organisms were Gram-negative bacilli or anaerobic streptococci. Only 25·0% were staphylococci or other Gram-positive organisms. The use of penicillin alone is therefore probably incorrect. In severe infection ampicillin or a combination of penicillin and kanamycin are probably the agents of choice initially. Prophylactic antibiotics were only administered after 24 hours of ruptured membranes, but 61·0% of all infections occurred in patients draining liquor for less than 24 hours. Infection may, therefore, already have occurred before starting therapy. Lebherz et al.° showed that maternal morbidity is reduced on antibiotics. However, most authors°° agree that prophylactic therapy is of no value.

**CONCLUSIONS**

We consider that conservative treatment, without antibiotic cover, should be employed when premature rupture of the membranes occurs between 28 and 34 weeks. The pregnancy should be terminated immediately if intra-uterine infection occurs or if the foetus is judged to be over 34 weeks' gestation.

All cases of proved infection must be carefully monitored and treated on a broad-spectrum parenteral antibiotic cover.

We should like to thank Mrs W. Gordon for her assistance with the statistical analysis of this series.

**REFERENCES**